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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application for Reissue of U.S. Patent No. 5,930,744

Inventors: Frank J. KOCH
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David J. BEAMISH

Application No.: Unassigned

Issued: July 27, 1999

For: COATING THICKNESS GAUGE

Group Art Unit: Unassigned

Examiner: Unassigned

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TRANSMITTAL LETTER FOR APPLICATION FOR REISSUE OF UNITED STATES UTILITY PATENT

Honorable Commissioner of Patents and Trademarks
Washington, D.C. 20231

Sir:

Transmitted herewith for filing is an application for reissue of United States Letters Patent No. 5,930,744 issued to Frank J. Koch, Leon C. Vandervalk and David J. Beamish, on July 27, 1999.

Enclosed are the following documents:

- a copy of the original Letters Patent No. 5,930,744 along with new claims 31-45;
- an unsigned Declaration under 37 C.F.R. §1.175(a);
- an Information Sheet; and
- a Request for Transfer of Formal Drawings.
- a Reissue Application Fee Transmittal Form

Also enclosed is the fee of $345.00 (the filing fee for Small Entity) as required by 37 C.F.R. §1.16(h) and the fee of $252.00 for the claims in excess of the number of claims in the original patent.

The Assent of the Assignee (Defelsko Corporation) and an Offer to Surrender the Original Letters Patent will be filed in due course once the Notice to File Missing Parts is received.

It is requested that all future correspondence relating to this application for reissue of United States Letters Patent No. 5,930,744 be addressed to:

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Please address all telephone calls to William C. Rowland.

The Commissioner is hereby authorized to charge any appropriate fees under 37 C.F.R. §§1.16, 1.17 and 1.21 that may be required by this paper, and to credit any overpayment to Deposit Account No. 02-4800. This paper is submitted in triplicate.

Respectfully submitted,
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REISSUE APPLICATION FEE TRANSMITTAL FORM

Docket Number: 007325-077

Claims as filed - Part 1

Claims in Patent	For	Number Filed in Reissue Application	Number Extra	Rate	Fee
30	Total Claims	45	15	× $18 =	$270.00
3	Independent	6	3	× $78 =	$234.00
				Basic Fee (37 CFR 1.16(h))	$690.00
				Total of above calculations	$1,194.00
				☒ Reduction by 50% for filing by small entity	$597.00
				Total Filing Fee	**$597.00**

Claims as Amended - Part 2

	Claims Remaining After Amendment (after any cancellation)	Highest Number Previously Paid For	Extra Claims	Rate	Fee
Total Claims		-	= 0	× $18 =	$0.00
Independent		-	= 0	× $78 =	$0.00
				Total of above calculations	$0.00
				☐ Reduction by 50% for filing by small entity	$0.00
				Total Additional Fee	**$0.00**

☐ Please charge Deposit Account No. 02-4800 in the amount of _____ A duplicate copy of this sheet is enclosed.

☒ The Commissioner is hereby authorized to charge any additional fees under 37 CFR 1.16 or 1.17 which may be required, or credit any overpayment to Deposit Account No. 02-4800. A duplicate copy of this sheet is enclosed.

☒ A check in the amount of **$597.00** to cover the filing/additional fee is enclosed.

April 3, 2000
Date

Timothy B. Kang P-46,423
Signature of Applicant, Attorney or Agent of Record

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Typed or printed name

(11/98)

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[11] **Patent Number: 5,930,744**

[45] **Date of Patent: *Jul. 27, 1999**

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[57] **ABSTRACT**

A modular coating thickness gauge includes a probe which generates a signal representative of coating thickness, a PCMCIA card connected to the probe for converting the signal into a standard PCMCIA output format, and a portable computing unit for receiving the signal via the PCMCIA card. The gauge allows the on-site user to alternately record coating thickness measurement data and descriptive textual or graphical data relating to each coating thickness measurement.

30 Claims, 5 Drawing Sheets

COATING THICKNESS GAUGE

BACKGROUND

1. Field of the Invention

The present invention relates to coating thickness gauges and more particularly to a novel method and apparatus for measuring and recording coating thickness data and associated descriptive data through a graphical user interface.

2. Description of the Related Art

The art of measuring the thickness of a coating on a substrate has produced a wide variety of coating thickness gauges for measuring a variety of materials. In general, coating thickness gauges include a probe which produces an electronic signal responsive to a measured physical quantity representative of a coating thickness. For example, when measuring the thickness of an electrically nonconductive coating on a conductive substrate, the probe can include an inductor which registers a change in impedance based on its proximity to the conductive substrate. The impedance change of the inductor is reflected by a change in frequency in an LC oscillator which can be mathematically related to the thickness of the coating.

Conventional coating thickness gauges have also provided the capability of transforming the electronic signal representative of coating thickness into digital data and of storing a number of data points for later downloading and analysis. Typically, the coating thickness measurements are later sequentially correlated to a written description of the article being measured. Such a procedure, however, requires the user to manually keep track of which data points correspond to which locations on the object being measured, and are thus time consuming and susceptible to recording errors.

Thus, although coating thickness gauges have been developed to provide very accurate digital readings, the industry has not yet produced a coating thickness gauge with a user interface which facilitates recording and analysis of data, despite the ongoing advances in computer technology. Prior to the present invention, there was a need in the art, therefore, for a method and apparatus for measuring and recording coating thickness data which is easy to use and which ensures accuracy and reliability in the recording of measurements.

OBJECTS AND SUMMARY

It is an object of the invention to provide a novel coating thickness gauge which allows a user to record thickness measurement data along with descriptive data through a user interface on a computer screen.

It is a further object of the invention to improve the accuracy of coating thickness measurement data by providing an apparatus which allows a user to alternate between recording a coating thickness measurement data point and recording descriptive textual or graphical data relating to the data point.

It is a further object of the invention to provide a modularized coating thickness apparatus which includes a probe which produces an electric signal representative of a measured coating thickness and a PCMCIA card which receives the electric signal and converts the electric signal into a digital data signal in a standard PCMCIA output format. The coating thickness apparatus preferably includes a portable computing unit or Personal Digital Assistant (PDA) with a port for receiving the PCMCIA card and a screen for providing a graphical user interface.

An exemplary method according to the present invention includes the steps of obtaining a plurality of coating thickness values with a probe electrically connected to an elec-

tronic memory, recording in the electronic memory the plurality of coating thickness values, and recording in the electronic memory a plurality of descriptive data units, each descriptive data unit being associated with one of the coating thickness values and defined, for example, with reference to an electronic pictorial representation of the coated article. The steps of recording the coating thickness values and of recording the descriptive data units may be performed alternately.

Exemplary embodiments of the invention provide the on-site user with the power of a personal computer together with an easy-to-use interface that does not require a keyboard. Among other advantages, the gauge improves the accuracy and reliability of coating thickness measurements, provides the flexibility of plugging in any probe (e.g., magnetic, eddy current, ultrasonic, etc.) to any PCMCIA-compatible device, and allows the user to perform data analysis on-site.

BRIEF DESCRIPTION OF THE DRAWINGS

The foregoing and other objects, features and advantages of the present invention will be more readily understood upon reading the following detailed description in conjunction with the drawings in which:

FIG. **1** is a perspective view of a coating thickness gauge according to an exemplary embodiment of the invention;

FIG. **2** is a schematic diagram of an exemplary PCMCIA card/probe unit;

FIG. **3***a* is an enlarged view of a portion of a first exemplary probe assembly;

FIG. **3***b* is a diagram of a second exemplary probe assembly;

FIG. **4** is a schematic diagram of a portable computing unit;

FIG. **5** is a diagram of an exemplary control display on the portable computing unit; and

FIG. **6** is a diagram of an exemplary output display on the portable computing unit.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIG. **1** is a perspective view of a coating thickness gauge according to an exemplary embodiment of the invention. The portable gauge **10** comprises a probe **20** connected by a cable **30** to an interface unit **40** such as a Personal Computer Memory Card International Association (PCMCIA) card. The PCMCIA card **40** is adapted to communicate with a portable computing unit **50** via a port **60**. The portable computing unit **50** is small enough to be held comfortably in the palm of one's hand. However, it preferably includes a relatively large screen display **70** to provide a graphical interface to the user. The screen **70** is preferably, though not necessarily, a touch-sensitive screen which can be activated, for example, with an index finger or with any suitable pointed writing instrument **80**. The portable computing unit **50** can be of the type generally known as a Personal Digital Assistant. The Apple NEWTON®, which provides a graphical user interface without a keyboard, is a preferred example of such a portable computing unit **50**.

The PCMCIA card **40** can be adapted to support a wide variety of peripheral devices, and due to its versatility, allows virtually any type of probe **20** to be incorporated into the thickness gauge **10**. For the purpose of illustration, two exemplary embodiments will now be described briefly in which a known type of probe **20** is implemented to measure the thickness of a coating on substrate. However, those skilled in the art will recognized that the PCMCIA card **40** can be adapted to support many other types of probes **20** in conjunction with the portable computing unit **50**.

According to one embodiment, as shown in FIG. **2** and as further described in commonly owned U.S. Pat. No. 5,293,132, entitled "Coating Thickness Measurement Gauge", which is hereby incorporated herein by reference, the probe **20** of the coating thickness gauge **10** can be the inductor **75** of an LC oscillator **85** of suitable, known type. The LC oscillator **85** allows for the measurement of the thickness of an electrically nonconductive coating on an electrically conductive substrate. The inductor **75** can be a simple air-core solenoid-type coil. The phrase "air-core" is meant to refer to a coil having a core made of nonmagnetic, nonmetallic material. In practice, the wire is wound around a nonmagnetic, nonmetallic rod. During measurement, a probe structure housing the probe is placed in contact with the surface of the coating such that the separation of the coil **75** and the electrically conductive substrate is a function of the geometry of the probe structure and the coating thickness.

The impedance of the coil **75** varies with its proximity to the electrically conductive substrate resulting in a corresponding variation in the oscillation frequency of the LC oscillator **85**. This frequency is determined by a counter **90** which is used in conjunction with a microprocessor **100**. For instance, a timing loop may be programmed into the microprocessor **100** such that it resets the counter **90** at the beginning of the timing loop and measures the period of time elapsed until a predetermined number of oscillations has occurred as indicated by an overflow signal. The number of measured oscillations should be large enough to achieve the desired accuracy.

The relationship of the change in frequency of the oscillator **85** to the coating thickness is dependent on the particulars of the geometry of the probe assembly **20**, shown in expanded detail in FIG. **3***a*. The most significant parameters affecting the relationship of the change in frequency to the coating thickness are the diameter r of the coil **75**, the number of turns of the coil **75**, the height I of the coil **75**, the gauge of the wire as it affects the dimension b, and the material of the wound wire. Furthermore, the relationship is different depending on the material composition of the substrate. For a nonmagnetic substrate such as aluminum, the relationship may be approximated by the fourth-order polynomial:

$$Y=A_0+A_1F+A_2F^2+A_3F^3+A_4F^4$$

where the coefficients A_{0-4} are determined by the geometry of the probe **20** and the electrical characteristics of the substrate.

For a six-turn single layer wound coil using 26-gauge copper wire, the coefficients A_{0-4} may be empirically determined and represented as follows for nonmagnetic aluminum substrates, with F representing the frequency change in KHz and Y representing the thickness in microns:

$$Y=10090.44-(26.965)F+(3.0195\times10^{-2})F^2-(1.60-374\times10^{-5})F^3+(+3.25473\times10^{-9})F^4$$

A complete set of coefficients A_{0-4} can be stored in a ROM portion **110** associated with the microprocessor unit **100** during production of the thickness 10 gauge for any desired substrate material. For example, an additional set of coefficients B_{0-4} can be stored for use with magnetic substrates. Thus, upon selection by the user of one of the substrate materials stored in memory, the coefficients associated with the selected substrate material can be recalled from the ROM **110** and employed along with the measured frequency change in the appropriate equation shown above for determining coating thickness.

According to a second exemplary embodiment, a second gauge probe can be used in conjunction with the present

invention to determine automatically, with a single probe, the substrate characteristics, and to effect a measurement of the coating thickness on that substrate. Such a probe is described for example in commonly owned U.S. Pat. No. 5,343,146, entitled "Combination Coating Thickness Gauge Using a Magnetic Flux Density Sensor and an Eddy Current Search Coil", which is hereby incorporated herein by reference. The probe tests for a ferrous substrate, measuring the temperature-compensated magnetic flux density at a pole of a permanent magnet using a Hall effect magnetic sensor and a thermistor. FIG. 3*b* shows a probe **25** which includes a permanent magnet **35**, a Hall effect magnetic sensor **45**, and a thermistor **55**. The magnetic flux density and temperature measurements are converted into a temperature-compensated magnetic flux density value that is proportional to the coating thickness on the ferrous substrate. If no ferrous substrate is detected, the coating thickness gauge automatically switches over to test for a conductive nonferrous substrate, measuring the effects of eddy currents generated in the conductive nonferrous substrate by the coating thickness gauge magnetic fields using an eddy current search coil **65**, as shown in FIG. 3*b*. The eddy current measurements are converted into an eddy current frequency value that is proportional to the coating thickness on the conductive nonferrous substrate.

Various other types of known probes may also be incorporated into the present invention, for example probes which measure coating thicknesses on ferrous substrates with a magnetic induction technique using two coils and a ferrous core. As discussed with regard to the first embodiment, the PCMCIA card **40** can be adapted to include hardware elements such as a counter or a ROM chip to support a desired coating thickness gauge probe. The gauge electronics **120** in FIG. **2** are thus intended to generally represent a capacity of the PCMCIA card **40** to include hardware elements to support any type of gauge probe. For example, as will be readily appreciated by those skilled in the art, the PCMCIA card **40** can be modified by one skilled in the art to include hardware to support probes which measure thicknesses of nonmagnetic coatings on ferrous substrates, nonconductive coatings on nonferrous substrates, combination probes which measure both, or probes which ultrasonically measure coating thicknesses on nonmetals.

In addition to the hardware support elements **120** included in the PCMCIA card **40** for a particular application, The PCMCIA card **40** also includes the microprocessor **100** and a PCMCIA interface **130** which creates a standardized communication path from the microprocessor **100** to the portable computing unit **50**. Included in the PCMCIA interface **130** is a Universal Asynchronous Receiver Transmitter (UART) **140**, an I/O device which sends and receives information in bit-serial fashion. The microprocessor **100**, in conjunction with the supporting hardware **120**, converts the signal from the probe **20** into a digital representation of a coating thickness which is transmitted through the UART **140** to the portable computing unit **50** in a standardized PCMCIA format. For brevity, the details of this process are omitted, as those skilled in the art are capable of adapting a particular signal to the PCMCIA format.

The physical attributes and internal operation of the PCMCIA card **40** are defined in detail by the Personal Computer Memory Card International Association, which updates the PCMCIA specifications periodically. The PCMCIA standard includes detailed specifications regarding the physical attributes of the card such as dimensions and mechanical tolerances, card interface information such as signal definitions for the connecting pins **125** of the PCMCIA card, and data organization on the card. Because the PCMCIA card is a standard interface, the present invention provides a versatile coating thickness gauge which can be used in a wide variety of hardware environments.

The portable computing unit **50** receives the PCMCIA card **40** via a port **60** to communicate with the probe **20**. The portable computing unit **50** includes, among other elements, a microprocessor **150** for controlling the operations of the coating thickness gauge **10**. See FIG. **4**. The portable computing unit **50** can be programmed, for example, to automatically recognize the type of probe which is connected to the portable computing unit **50**. The microprocessor **150** is associated with a memory **160** which can store computer programs which control the operation of the gauge **10**. The microprocessor **150** exchanges data with the memory **160** and with the user via the screen **70** which is large enough to provide a graphical interface for the user. The versatility provided by the memory **160**, the microprocessor **150**, the large screen **70**, and the standard PCMCIA interface thus provide the coating thickness gauge **10** of the present invention with many important advantages. Exemplary embodiments of the invention, for example, provide the user with the ability to perform complete data analysis or statistical process control on-site, the flexibility of using any probe with any PCMCIA-compatible portable computing unit **50**, and the capability of providing a sophisticated user interface which allows the user to easily annotate coating thickness measurements with descriptive textual and graphical data.

According to one exemplary method of the invention, a user of the gauge **10** alternates between recording a thickness measurement reading with the probe **20** and entering descriptive data via the screen **70**. The descriptive data can be entered in a number of ways. For example, a virtual typewriter keyboard can be graphically simulated on the screen **70** for entry of descriptive comments relating to a particular thickness measurement using an index finger or a pointed writing instrument **80**. Alternatively, the portable computing unit **50** can be adapted to convert a handwritten image, created by handwriting on the screen with the writing instrument **80**, into textual data. The process of converting a handwritten image of "electronic ink" or typed letters into digital textual data, which has been incorporated into the Apple NEWTON®, greatly facilitates the entry of descriptive data associated with a particular coating thickness measurement. The ability to label all or selective individual data points with descriptive text also enhances the reliability of the measured coating thickness data by ensuring that data points are properly labeled and by allowing the user to immediately record any abnormalities as measurements are taken.

According to a further exemplary method, a two- or three-dimensional image of the object to be measured can be created on the screen **70** by the user as a reference for input coating thickness data points. According to this method, a user first recalls or sketches a diagram of the object to be measured on the screen **70** of the portable computing unit **50** using the writing instrument **80**. This process can be facilitated with a program, included in the Apple NEWTON, which transforms user-created images into various geometrical forms such as rectangles and circles. The drawing is then stored in the memory **160** as a reference for the measured thickness values. As coating thickness values are obtained with the probe **20**, the user identifies, with reference to the screen drawing, the locations on the object at which the coating thickness values were obtained. In addition, the user can input for any coating thickness value, a textual description relating to the measured data point. FIG. **1** is an example which depicts a drawing of a coated pipe **170** which a user would measure to obtain coating thickness values at various locations. After taking a measurement of the actual pipe with

the probe **20**, the user simply indicates the location of the data point with reference to the pictorial representation on the screen **70** using the writing instrument. The screen thus serves as a graphical interface to record the location of data points **180**, as shown in FIG. **1**.

The large touch-sensitive screen **70** of the portable computing unit **50** can be further adapted to facilitate operation of the coating thickness gauge **10** with a number of virtual buttons. As shown in FIG. **5**, the screen **70** can include several virtual buttons **190** which, for example, allow the user to enter a memory mode to begin storing thickness measurements, enter high and low tolerance limits, command the gauge to compute and display statistics on the data thus obtained, enter parameters specifying a particular process used in applying a coating, specify units for the coating thickness readings, or any other desired function. The process control button can be used for, among other functions, labeling any batch with a particular process used in coating. This feature facilitates data analysis by allowing the user to analyze a group of batches associated with the same coating process. Calibration buttons **200** are provided to calibrate the gauge when a reading differs from a known thickness.

At the top of the screen **70**, a display section **210** may be provided which displays thickness readings with units, an indicator of whether a ferrous or nonferrous material was measured, a textual description of a particular batch, and a label for a particular process used in coating. The screen **70** shown in FIG. **5** is of course intended to provide an example illustrating the versatility of one embodiment of an exemplary coating thickness gauge. It will be readily appreciated by those skilled in the art, however, that many modifications in the screen interface can be affected without departing from the scope of the invention.

The screen **70** can also be adapted to provide graphical output, which advantageously allows the on-site user to use statistical process control in analyzing coating thickness measurements. FIG. **6** shows an exemplary output screen which includes graphs **220** and **230** of x-bar and range for a set of batches, a histogram **240**, and a list of desired statistics **250** for the stored readings. The x-bar graph **220** shows on the screen **70** a computed average thickness value for each batch. The range graph **230** shows a computed difference in thickness between the greatest and least measured thickness in a particular batch. These graphs thus allow the user to easily monitor any anomalies or trends in the coating process. Moreover, according to an exemplary embodiment of the invention, the user can access any annotations or other descriptive data associated with a batch or thickness measurement simply by touching the displayed batch number, data point, or other indicia on the screen **70** with the writing instrument **80**. This capability allows the user to determine, for example, whether anomalies illustrated in the output graphs are associated with any anomalies described in annotations recorded during measurement.

The histogram **240** provides an additional visual indicator of the consistency of recorded coating thickness measurements. The list of statistics **250** can include, among other parameters, a standard deviation calculated from measurements of selected batches, a maximum and a minimum reading, upper and lower set limits (USL, LSL) set by the user, and upper and lower control limits (UCL, LCL) which represent the average thickness plus or minus three standard deviations. Like the screen of FIG. **5**, the output screen in FIG. **6** is, of course, intended to show one embodiment which may be modified, for example, to accommodate other statistical process control operations without departing from the scope of the invention.

The present coating thickness gauge according to exemplary embodiments of the invention thus provides many important advantages in obtaining coating thickness measurement data. By combining a portable computing unit such as a Personal Digital Assistant with a coating thickness gauge probe via a PCMCIA interface, the invention greatly enhances the computing options available for obtaining and processing coating thickness measurements on-site. Thus, the user may perform data analysis, enter descriptive comments, control the gauge with icons, and generally harness the power of a large display, resident software, and regular upgrades of the portable computing unit. Moreover, these advantages are provided in a coating thickness gauge which is substantially less expensive to manufacture than commercially available gauges.

The above-described exemplary embodiments are intended to be illustrative in all respects, rather than restrictive, of the present invention. Thus the present invention is capable of many variations in detailed implementation that can be derived from the description contained herein by a person skilled in the art. All such variations and modifications are considered to be within the scope and spirit of the present invention as defined by the following claims.

What is claimed is:

1. A method of recording coating thickness measurements, comprising the steps of:

obtaining a plurality of coating thickness values with a probe electrically connected to an electronic memory;

recording in the electronic memory the plurality of coating thickness values; and

recording in the electronic memory a plurality of descriptive data, each descriptive data is associated with a respective one of the coating thickness values and provides information concerning the respective one coating thickness value.

2. The method of claim 1, wherein the steps of recording the coating thickness values and of recording the descriptive data are performed alternately.

3. The method of claim 1, wherein the coating thickness values are transmitted to the electronic memory via a PCMCIA card.

4. The method of claim 1, wherein the descriptive data comprise text.

5. The method of claim 1, wherein the descriptive data are recorded by transforming text handwritten on a computer screen with a writing instrument into digital data.

6. The method of claim 1, wherein the descriptive data are defined with reference to an electronic pictorial representation of a coated article.

7. The method of claim 6, wherein the descriptive data represent locations on the electronic pictorial representation of the coated article.

8. The method of claim 1, further comprising the step of displaying a plurality of indicia on a graph on a video display screen, the indicia representing the plurality of coating thickness values.

9. The method of claim 8, further comprising the step of retrieving one of the descriptive data by selecting on the graph one of the indicia.

10. An apparatus for measuring a coating thickness, comprising:

a probe which generates a first signal representative of a measured coating thickness; and

a PCMCIA card connected to the probe and which receives the first signal from the probe, the PCMCIA card including means for converting the first signal into a second signal which is compatible with a standard PCMCIA output format.

11. The apparatus of claim 10, wherein the probe comprises an LC oscillator.

12. The apparatus of claim 11, wherein the PCMCIA card includes a counter which measures a frequency of the LC oscillator.

13. The apparatus of claim 10, wherein the probe comprises a permanent magnet and a Hall sensor.

14. The apparatus of claim 13, wherein the probe further comprises an eddy current search coil.

15. The apparatus of claim 10, wherein the probe includes means for discriminating between a ferrous and a nonferrous substrate upon which the coating is coated.

16. The apparatus of claim 10, further comprising a portable computing unit which includes a PCMCIA port for receiving the PCMCIA card.

17. The apparatus of claim 16, wherein the portable computing unit includes a touch-sensitive screen, and the portable computing unit receives descriptive data from a user via the screen.

18. The apparatus of claim 17, further comprising a pointed writing instrument for entering the descriptive data.

19. The apparatus of claim 17, wherein the portable computing unit comprises a memory and is adapted to alternately record in the memory the descriptive data from the user and numerical data from the second signal which numerical data represent a coating thickness.

20. The apparatus of claim 19, wherein the descriptive data are defined with reference to a pictorial representation on the screen of an article upon which a coating is coated.

21. An apparatus for measuring and recording coating thickness measurements, comprising:

an electronic memory;

means for obtaining a plurality of coating thickness values with a probe electrically connected to the electronic memory;

means for recording in the electronic memory the plurality of coating thickness values; and

means for recording in the electronic memory a plurality of descriptive data so that each descriptive data is associated with a respective one of the coating thickness values and provides information concerning the respective one coating thickness value.

22. The apparatus of claim 21, wherein the coating thickness values are transmitted to the electronic memory via a PCMCIA card.

23. The method of claim 1, wherein the descriptive data includes textual descriptions of the associated coating thickness values.

24. The method of claim 1, wherein the descriptive data includes an image of an object measured to obtain the plurality of coating thickness values.

25. The method of claim 1, wherein the descriptive data provides a description of a source of the coating thickness values.

26. The apparatus of claim 21, wherein the descriptive data includes textual descriptions of the associated coating thickness values.

27. The apparatus of claim 21, wherein the descriptive data includes an image of an object measured to obtain the plurality of coating thickness values.

28. The apparatus of claim 21, wherein the descriptive data provides a description of a source of the coating thickness values.

29. The method of claim 1, further comprising the step of inputting the plurality of descriptive data via an input device prior to recording the plurality of descriptive data.

30. The apparatus of claim 21, further comprising means for inputting the plurality of descriptive data.

* * * * *

31. A method of recording coating thickness measurements with an electronic device that includes a probe connected to an electronic memory, the method comprising the steps of:

(a) taking a coating thickness reading at a location with a probe to obtain a coating thickness value;

(b) recording the coating thickness value in the electronic memory;

(c) after recording the coating thickness value in the electronic memory, inputting to the electronic device descriptive data concerning the coating thickness value; and

(d) recording the descriptive data in the electronic memory so that the descriptive data is associated with the coating thickness value in the memory.

32. The method according to claim 31, wherein the descriptive data identifies the location from which the coating thickness reading was taken.

33. The method according to claim 31, further comprising repeating steps (a) through (d) a plurality of times so that there is a plurality of coating thickness values in the electronic memory and each of the coating thickness values is associated with its respective descriptive data.

34. The method according to claim 33, further comprising the step of performing a statistical analysis of the plurality of coating thickness values.

35. The method according to claim 31, wherein the electronic device includes a screen, and using the screen as a graphical interface to input the descriptive data.

36. The method according to claim 35, wherein the data is entered using a pictorial representation of the location.

37. The method according to claim 35, wherein the screen is a touch-sensitive screen and the data is entered by touching the screen.

38. The method according to claim 35, wherein the data is entered by converting handwriting on the screen into text data.

39. An apparatus for taking a coating thickness measurement, comprising:

a probe which generates a signal representative of a measured coating thickness; and

a connector connected to the probe for connecting the probe to any one of a number of different commercially available types of nondedicated, palm-size, personal computing devices, the connector including a standard interface usable with any one of the personal computing devices.

40. The apparatus of claim 39, wherein the personal computing devices are PDA's (Personal Digital Assistants).

41. The apparatus of claim 40, wherein the PDA's include a screen display interface.

42. An apparatus for taking a coating thickness measurement, comprising:

a probe which generates a signal representative of a measured coating thickness;

a signal convertor that receives the signal generated by the probe; and

a connector connected to the signal convertor for connecting the apparatus to

any one of a number of different commercially available types of nondedicated, palm-size, personal computing devices, the connector including a standard interface usable with any one of the personal computing devices.

43. The apparatus of claim 42, wherein the signal convertor is a microprocessor that receives the signal generated by the probe and converts the signal generated by the probe into a signal usable by any one of the number of different types of nondedicated, palm-size personal computing devices.

44. The apparatus of claim 42, wherein the personal computing devices are PDA's (Personal Digital Assistants).

45. The apparatus of claim 44, wherein the PDA's include a screen display interface.

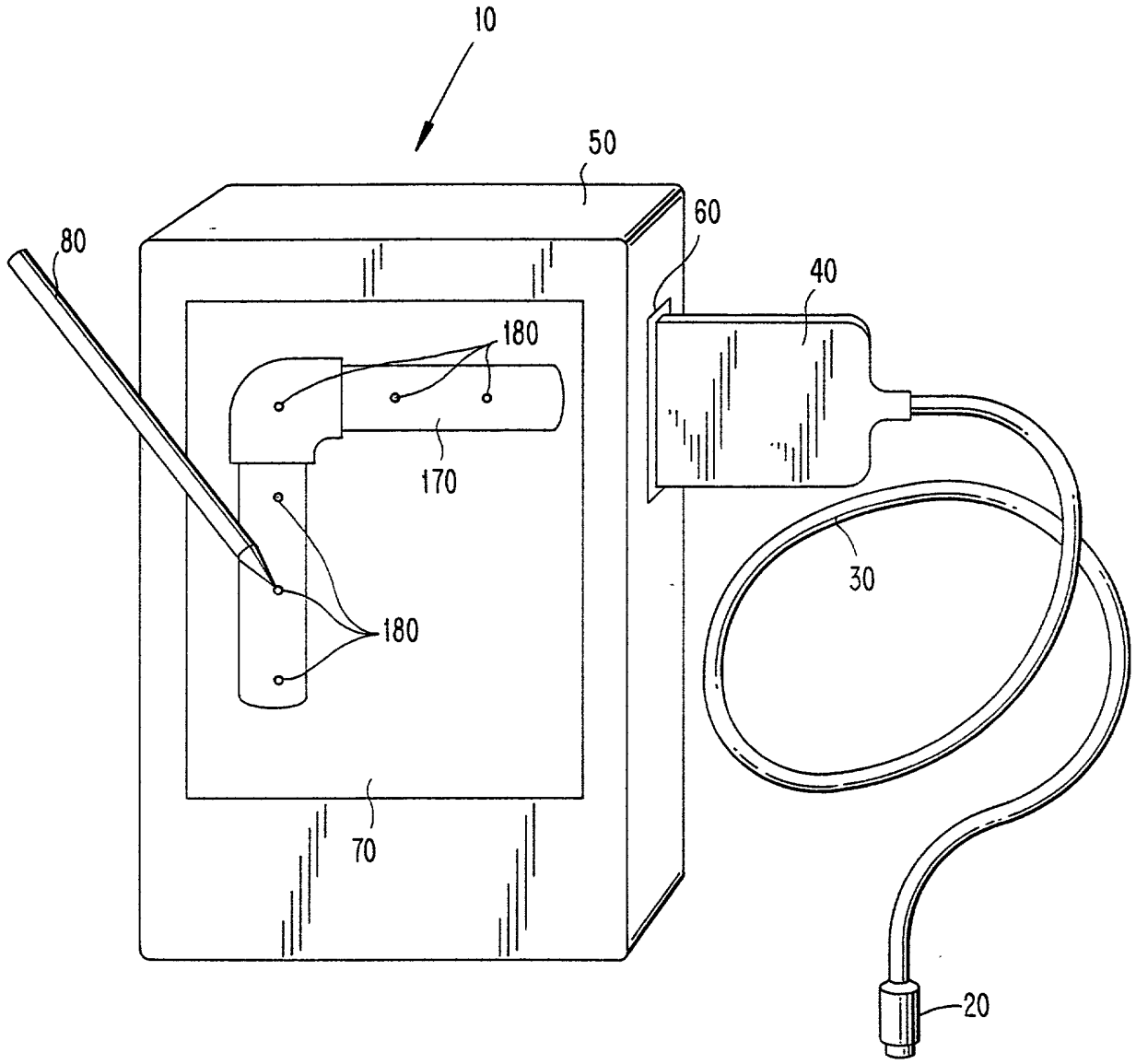


FIG. 1

FIG. 2

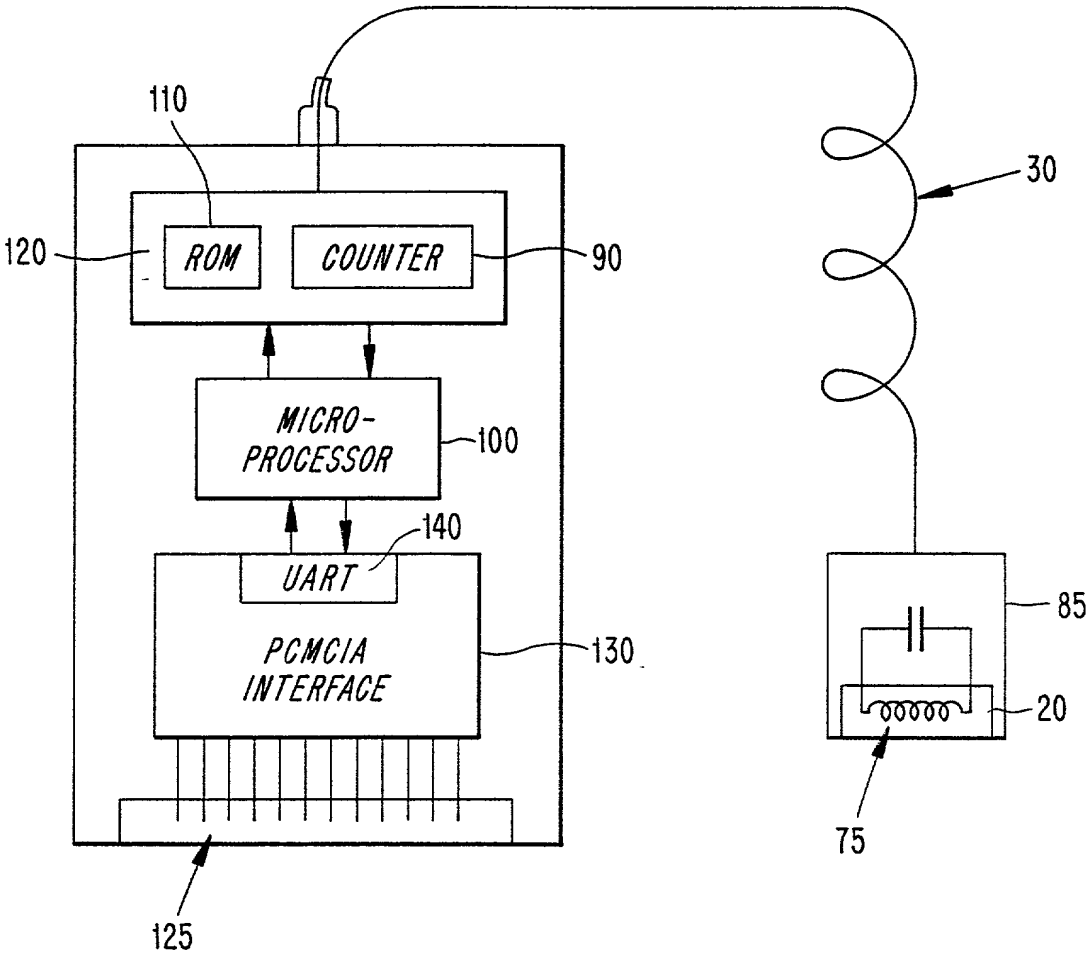

110
120
ROM
COUNTER
90
30
MICRO-
PROCESSOR
100
140
UART
PCMCIA
INTERFACE
130
85
20
75
125

FIG. 3a

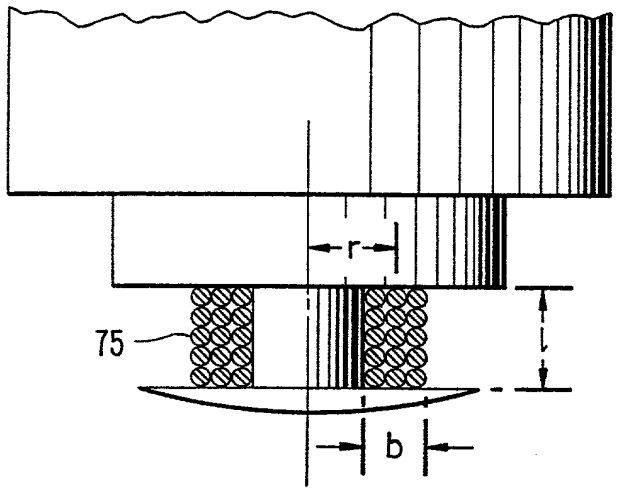

r
75
t
b

FIG. 3b

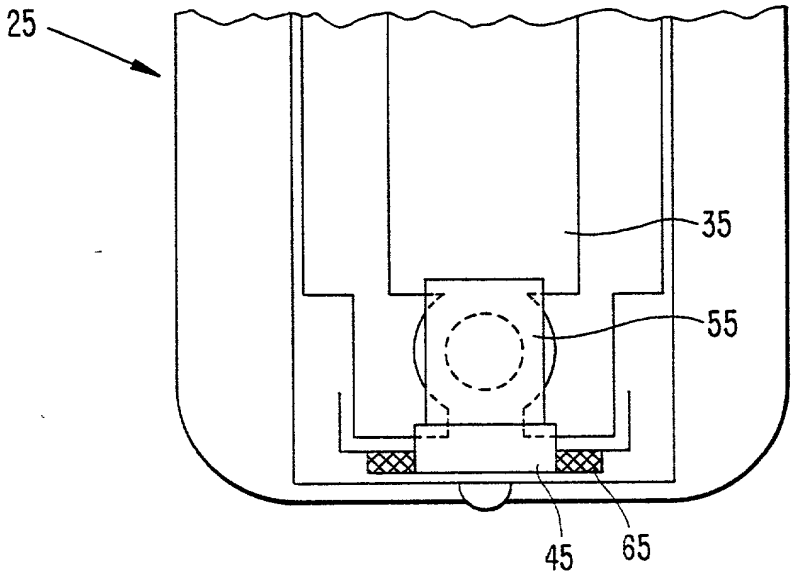


FIG. 4

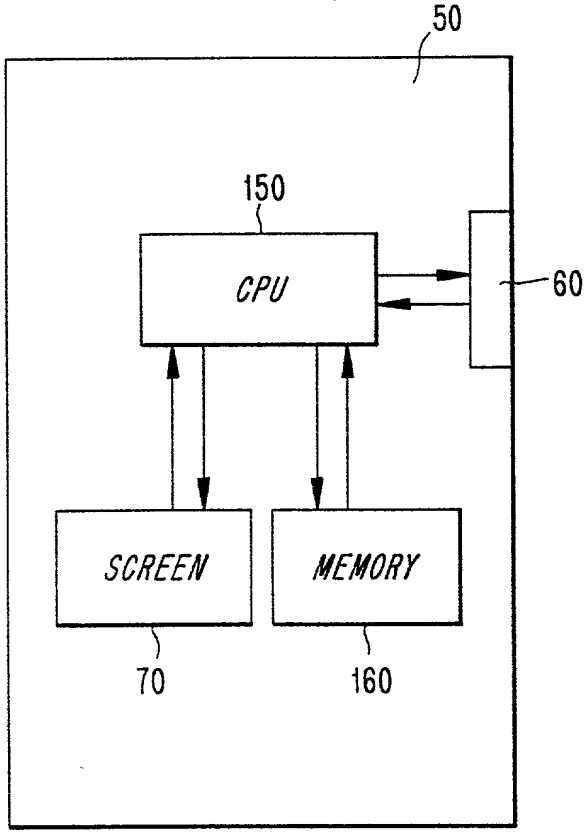


FIG. 5

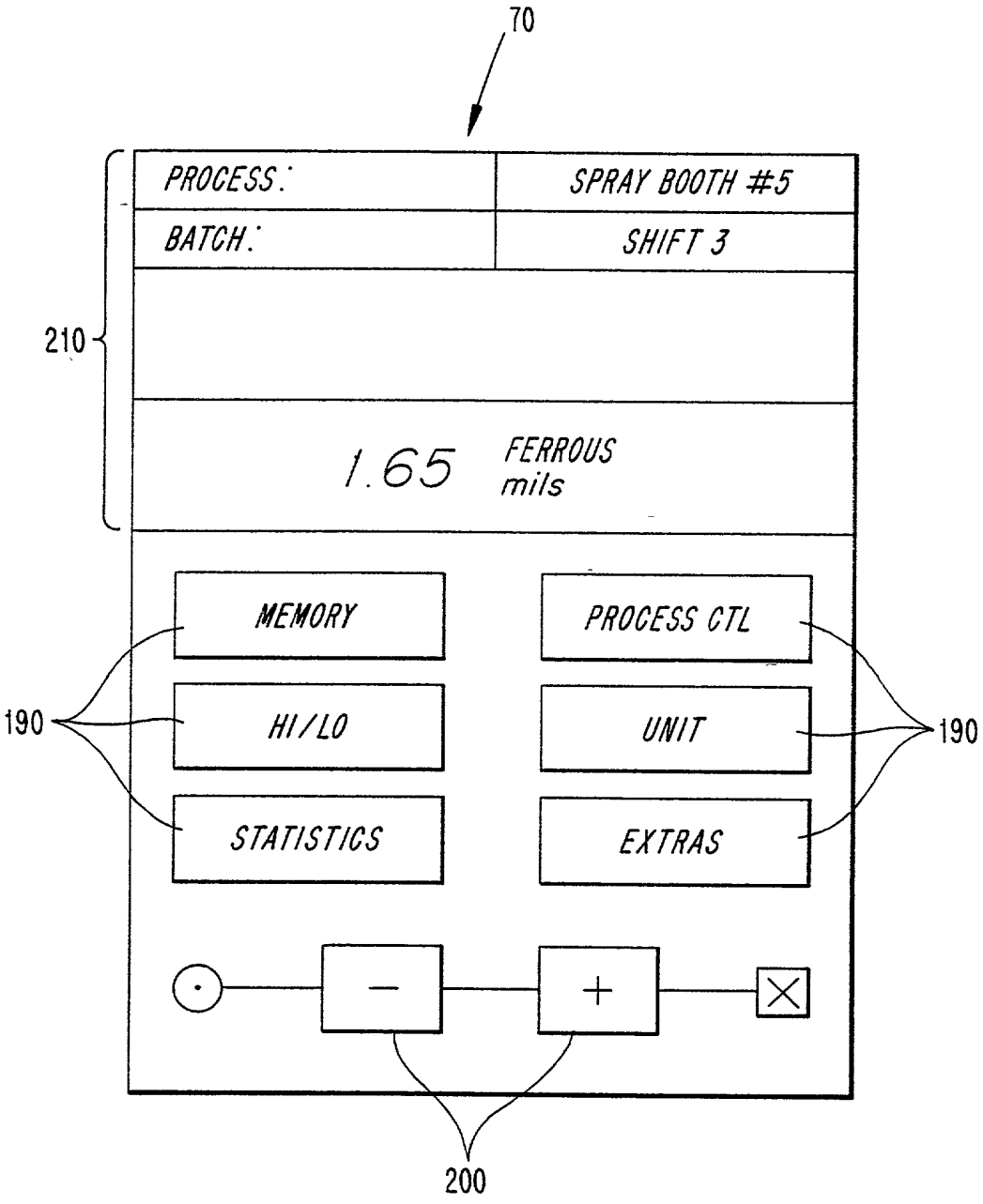
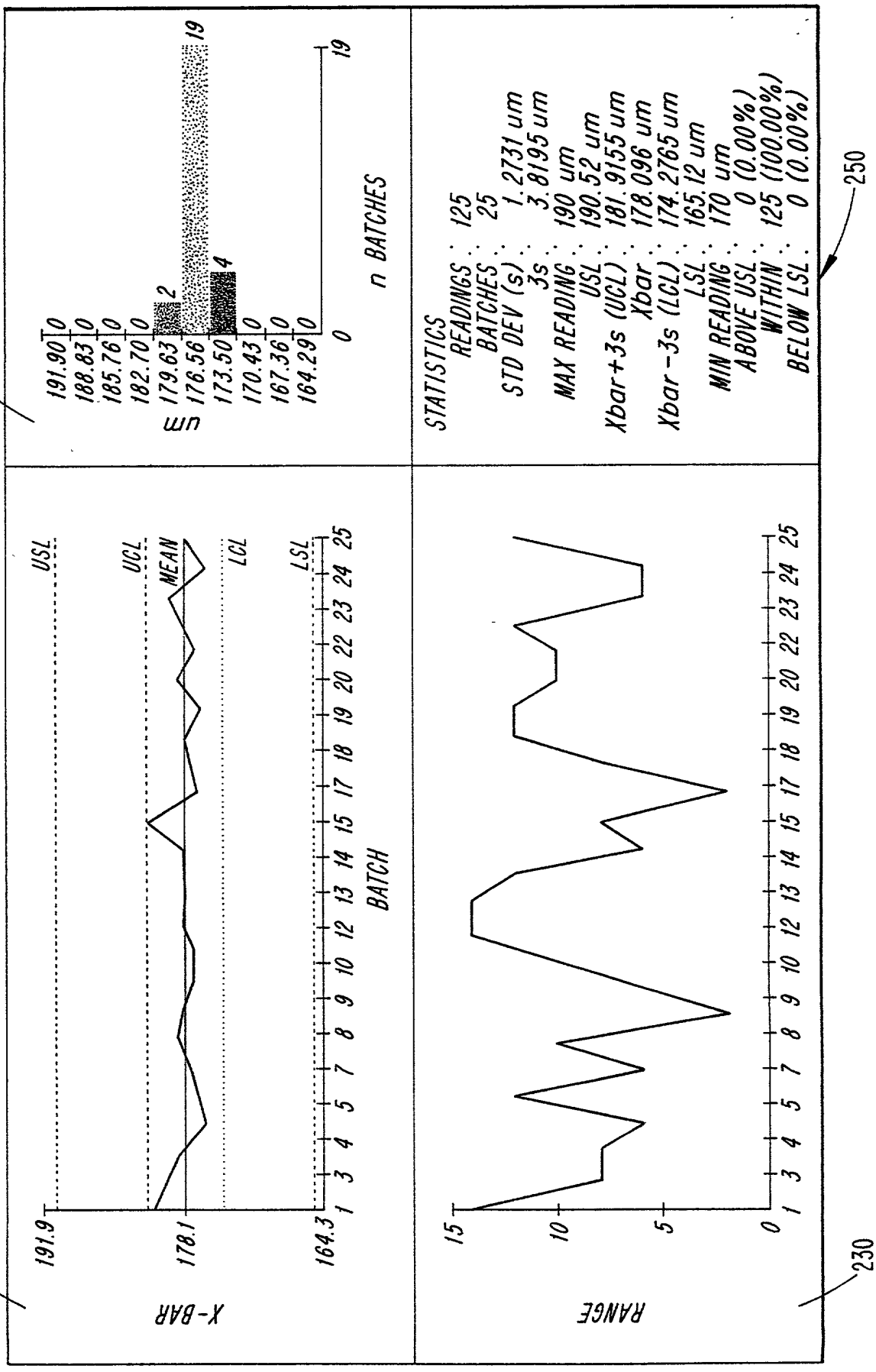

70
PROCESS:
SPRAY BOOTH #5
BATCH:
SHIFT 3
210
1.65
FERROUS
mils
MEMORY
PROCESS CTL
HI/LO
UNIT
STATISTICS
EXTRAS
190
190
200

FIG. 6


240
um
191.90 0
188.83 0
185.76 0
182.70 0
179.63 2
176.56 4
173.50 0
170.43 0
167.36 0
164.29 0
0
19
n BATCHES
STATISTICS
READINGS : 125
BATCHES : 25
STD DEV (s) : 1.2731 um
3s : 3.8195 um
MAX READING : 190 um
USL : 190.52 um
Xbar+3s (UCL) : 181.9155 um
Xbar : 178.096 um
Xbar-3s (LCL) : 174.2765 um
LSL : 165.12 um
MIN READING : 170 um
ABOVE USL : 0 (0.00%)
WITHIN : 125 (100.00%)
BELOW LSL : 0 (0.00%)
250
220
X-BAR
USL
UCL
MEAN
LCL
LSL
191.9
178.1
164.3
1 3 4 5 7 8 9 10 12 13 14 15 17 18 19 20 22 23 24 25
BATCH
230
RANGE
15
10
5
0
1 3 4 5 7 8 9 10 12 13 14 15 17 18 19 20 22 23 24 25

#4

Patent
Attorney's Docket No. 007325-077

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Reissue Application of)
U.S. Patent No. 5,930,744)
)
Inventors: Frank J. KOCH) Group Art Unit: Unassigned
Leon C. VANDERVALK)
David J. BEAMISH) Examiner: Unassigned

OIPE JC76
JUN 05 2000
PATENT & TRADEMARK OFFICE

Application No.: Unassigned

Issued: July 27, 1999)
)
For: COATING THICKNESS GAUGE)

DECLARATION UNDER 37 C.F.R. §1.175(a) AND POWER OF ATTORNEY

Assistant Commissioner for Patents
Washington, D.C. 20231

Sir:

We, Frank J. Koch, a citizen of Canada and a resident of Ogdensburg, New York, USA, having a post office address of RD #4, Box 139, Ogdensburg, New York 13669; Leon C. Vandervalk, a citizen of Canada and a resident of Brockville, Ontario, Canada, having a post office address of Lot 36, Concession 4, Port 2, Augusta, RR2, Brockville, Ontario, Canada K6V 5T2; and David J. Beamish, a citizen of Canada and a resident of Brockville, Ontario, Canada, having a post office address of 4 Colton Street, Brockville, Ontario, Canada K6V6W4, the undersigned Petitioners, hereby declare that we verily believe that we are the first, original and joint inventors of the subject matter which is described and claimed in this application for reissue and for which reissue of the original Letters Patent on the invention entitled "COATING THICKNESS GAUGE" is sought. We do not know and do not believe that the invention was ever known or used before the invention thereof was made.

The entire right, title and interest in and to United States Letters Patent No. 5,930,744 granted on July 27, 1999 and entitled "COATING THICKNESS GAUGE" is vested in Defelsko Corporation, a corporation existing under the laws of the United States and having a place of business in Ogdensburg, New York.

Petitioners further declare the following:

We verily believe United States Letters Patent No. 5,930,744 (the '744 patent) may be at least partly inoperative for the reason that we claimed less than we had a right to claim in the patent. Specifically, the '744 patent did not include Claims 31-45, which are included with this application.

All errors being corrected in this reissue application up to the time of filing of the oath or declaration arose without any deceptive intention on our part.

We have reviewed and understand the contents of the specification, including the claims, as amended by any amendments specifically referred to in the oath or declaration of the above-identified Reissue Patent Application.

We acknowledge the duty to disclose information of which we are aware that is material to the examination of the above-identified Reissue Patent Application in accordance with Title 37, Code of Federal Regulations, § 1.56.

We hereby appoint Ronald L. Grudziecki, Registration No. 24,970 and William C. Rowland, Registration No. 30,888, to prosecute and transact all business in the U.S. Patent and Trademark Office in connection with the above-identified reissue application.

The undersigned Petitioners hereby declare further that all statements made herein of our own knowledge are true, and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

Respectfully submitted,

Date: April 13, 2000 By: Frank J. Koch

Date: April 13, 2000 By: Leon C. Vandervalk

Date: April 13, 2000 By: David J. Beamish